IMPACT OF AEROBIC EXERCISE TRAINING VERSUS CIRCUIT WEIGHT TRAINING ON IMPROVING EXERCISE CAPACITY IN CABG PATIENTS

Register No- **27103214**

This dissertation is submitted to

THE TAMILNADU Dr MGR MEDICAL UNIVERSITY, Guindy

In partial fulfillment for the requirements of the degree of

MASTERS OF PHYSIOTHERAPY

Specialty: Advanced Cardio Respiratory in Physiotherapy

APRIL 2012

CERTIFICATE

This is to certify that the dissertation title **'IMPACT OF AEROBIC EXERCISE TRAINING VERSUS CIRCUIT WEIGHT TRAINING ON IMPROVING EXERCISE CAPACITY IN CABG PATIENTS'** is a bonafide record of work done under the guidance and supervision in the partial fulfillment for the degree of **MASTER OF PHYSIOTHERAPY** (MPT) April 2012 by **Mr. N.MAHESH PRABHA**, *(Registered No (27103214)* post graduate student of **MADHA COLLEGE OF PHYSIOTHERAPY, Kundrathur, Chennai – 69.**

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The Tamil nadu Dr.M.G.R Medical University, Chennai

In partial fulfillment for the requirements of the degree of

Master of physiotherapy

April-2012

ACKNOWLEDGEMENT

I express my gratitude to my God for his abundant grace and mercy that had made me succeed in life.

I express heartiest thanks to my family members for their outstanding support sacrifice and prayers that has enabled me to spell success in life.

I am grateful to the chairman and the management of the Madha education trust for providing me an opportunity to do my post graduate study.

I very sincerely thank our beloved Principal. P Prof. J. Balamurugan ,M.P.T. , M.I.A.P., M.H.P.C., for his valuable suggestion and constant support

I wish to thank by guide Mr. P.Anantharaja ,M.P.T., M.I.A.P., Asst Prof. for his support and valuable knowledge and completing my work.

I also wish to thank Mr.S.Nagaraj, M.P.T.,M.I.A.P.,Vice principal and Mrs. Mercy, M.P.T.,M.I.A.P., Asst Prof. for their ideas and support

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1.1 INTRODUCTION

Coronary artery bypass grafting (CABG) has become a common operation for ischaemic heart disease since 1967.The aim of CABG is to relieve the symptoms of angina and in certain group of patients to prolong life. A median sternotomy is used for CABG and the operation is performed using cardiopulmonary by pass. Reversed segments of the long saphenous vein are used to form bypass grafts from the ascending aorta to the coronary artery distal to the stenosis, up to five to six grafts may be required. The majority of patients are fit to leave hospital one week after surgery.

Operative mortality is now less than 2% and at 1 year after surgery. Over 85% of patients are symptom free. Because of the attrition rate of vein grafts, surgeons are now using the internal mammary artery on one or both sides. The patency of the internal mammary artery at 7 years 95% is superior to that of saphenous vein grafts (70%) sometimes right gastroepiploic artery is used.

After Coronary artery bypass grafting there is a decrease in cardiac function and exercise capacity. Hayberg stated that if exercise training is continued and progressively increased in intensity, duration and frequency have improved cardiac function and exercise capacity.

Comprehensive cardiac rehabilitation programme includes advice on diet and modification in exercise sessions including aerobic and strength training, elements improved peak Vo_2, cardiac output and parasympathetic nerve activity and energy conservation technique to improve the functional and exercise capacity of CABG patient.

Since both aerobic exercise training and strength exercise training improves the exercise capacity of CABG patients, this study is intended to compare the aerobic exercise and strengthening exercise through circuit weight training to find out the effectiveness of treatment after Coronary artery bypass grafting which will help the patients to improve the exercise capacity as early as possible.

1.2 AIM OF THE STUDY

To compare the effectiveness between aerobic exercise training and circuit weight training on exercise capacity after coronary artery bypass grafting surgery.

1.3 NEED FOR THE STUDY

Sub optimal mucociliary escalation,Decreased lung volume and capacities,
Mucus retension in lung,Requirement of increased work of breathing are affected due to the effect of anaesthesia, blood loss during surgery and restricted chest wall mobility due to surgical incision primarily affects the O_2 transport.

Even various modalities and techniques are available but nevertheless none of the techniques so far has been shown to produce the required improvement. Hence the post operative treatment still remains to be optimized and lacks the much needed standardization.

1.4 OBJECTIVES OF THE STUDY

- ⇨ To determine the effect of Aerobic training on exercise capacity after coronary artery bypass graft surgery.
- ⇨ To determine the effect of circuit weight training on exercise training capacity after coronary artery bypass graft surgery.
- ⇨ To compare the difference between circuit weight training and aerobic exercise training on improving exercise capacity after coronary artery bypass graft surgery.

1.5 HYPOTHESIS

ALTERNATE HYPOTHESIS:

There is a significant difference of improvement in exercise capacity between experimental and control group.

NULL HYPOTHESIS:

There is no significant difference of improvement in exercise capacity between experimental and control group.

1.6 OPERATIONAL DEFINITIONS

Coronary Artery Bypass Grafting (CABG):

Coronary Artery Bypass Grafting is a surgical revascularization of the myocardium accomplished by anastamosing the saphenous vein to the aortic root and to the stenosis and or direct revascularization by anastamosing the distal end of the internal mammary artery to the coronary artery distal to the lesion.

Aerobic exercise training:

Aerobic exercise training is an augmentation of the energy capacity of the muscle by means of an exercise program. Training is dependent on exercise of sufficient intensity, duration and frequency.

Circuit weight training:

Circuit weight training are resistance exercise carried out in a specific sequence using a variety of exercise for total body conditioning.

MET

MET is used as a means of expressing the intensity and energy expenditure of activities in a way comparable among persons of different weight. Actual energy expenditure (e.g., in calories or joules) during an activity depends on the person's body mass; therefore, the energy cost of the same activity will be different for persons of different weight.

2.0 REVIEW OF LITERATURE

1. **Froelicher et al (1985)**

   Conducted an experimental study on 29 patients to find out the effectiveness of appropriate endurance training on cardiac function in patients with prior myocardial infarction. The selected patients were grouped into three. 1st group is controlled, 2nd group received low intensity training and 3rd group received high intensity training for 2 months. The treatment outcomes were measured by stroke volume and ejection fraction. The results showed that the high intensity training group had marked improvement in cardiac function.

2. **Santa Clara et at (1987)**

   Conducted an experimental study on 37 male patients after CABG to find out the effect of exercise training on lipoprotein, the selected patients were divided into two groupa; control and training group. Training group received bicycling training program for 12 weeks. The treatment outcome was measured by high density lipid cholesterol concentration. The results of this study concluded that there was an increased HDL cholesterol concentration and significant decrease in plasma triglycerine.

3. **Agren et al (1989)**

   Conducted an experimental study on 17 patients to find out the effectiveness of aerobic and resistance exercise on central haemodynamic response in severe chronic heart failure. The selected patients were treated by submaximal upper and lower limb resistance exercise and submaximal peak cycling. The results of this study concluded that the resistance exercises performed at appropriate intensity induced a similar hemodynamic burden to aerobic exercise in patients with chronic heart failure.

4. **Harral et al (1991)**

Conducted an experimental study on 53 male patients after CABG to find out the effect of aerobic exercise training. The selected patients were divided into two groups; one group received supervised aerobic exercise program and other group received usual community care for one year. The treatment outcomes were assessed by maximal VO_2 and ECG. The results of this study concluded that there was significant declines in resting heart rate.

5. **Vanhas L et al (1992)**

Conducted an experimental study on 24 post CABG patients to find out the effect of hydraulic circuit training on stroke volume, cardiac output, aerobic power, muscular strength and endurance. The selected patients were grouped into 3 groups. One group was controlled and another group received hydraulic circuit training for 8 weeks, 3 circuit per day, at work rest ratio 1:1, the 3rd group received cycle training exercise on bicycle ergometer for 8 weeks. The treatment outcomes were measured by Cybex 2 isokinetic dynamometer for muscular strength and endurance and symptoms limited graded exercise test on bicycle ergometer for cardio vascular fitness. The result showed that hydraulic circuit training can elicit significant improvement in both cardiovascular fitness and muscular strength and endurance than cycle training group.

6. **Adachi et al (1993)**

Conducted an experimental study on 26 CABG patients to find out the effect of circuit weight training on muscular strength, peak O_2 consumption and myocardial O_2 demand. Patients were randomized into control group and circuit weight training group for 10 weeks. Both groups were assessed by 1 RM technique for muscular strength, treadmill for VO_2 and rate pressure product for maximal VO_2.

Results showed that moderate intensity circuit weight training was safe and improved strength.

7. **Wosornu D et al (1996)**

Conducted a study on 36 Coronary artery disease patients to find out the effect of combined resistance and aerobic training Vs aerobic training alone. Patients were randomized into aerobic training group and aerobic with resistance training group for 6 months. Treatment outcomes were assessed by heart rate and rate pressure product, present body fat. Results concluded that resistance with aerobic exercise lowered the resting and submaximal exercise heart rate and rate pressure product and also increased lean mass in total body regions.

8. **Wosornu D et al (1998**)

Performed a study on coronary artery disease atients to find out effect of combining weight and aerobic training. Patients randomized into 3 groups. Group A received aerobic and weight training, Group B received only aerobic training and Group C is controlled for 1 year. Outcome measures were treadmill and gas analysis technique. Results indicated thet combining weight and aerobic exercise increased the ventilator threshold and aerobic training group showed marked improvement in VO_2 and the functional capacity.

9. **Maiorana et al (1997)**

Performed a study on 20 males after CABG to determine the effectiveness of additional physical activity during cardiac rehabilitation on heart rate recovery. Patients randomized into Active group which received additional walking $\geq$ 5434 steps/day and Less active group which received the usual cardiac rehabilitation protocol. Pedaling exercise is used as an outcome measure. Results concluded that additional physical activity had a markedly improved heart rate recovery.

10. **Stable A et al (1999)**

Performed a study to determine the effect of aerobic training in exercise capacity and heart rate variability among 65

elderly patients after an acute coronary artery event. Patient randomized into control group and aerobic group. Aerobic group received outpatient training program of 5 minutes, 3 times/day for 3 months. ECG was the outcome measure. Results showed that regular aerobic exercise improved exercise capacity and modified heart rate variability.

11. **Takayama et al (2000)**

Performed a study on 28 CABG patients to determine the effect of additional physical training on autonomic nervous activity. Patients were randomized as control group and training group. Training group received aerobic exercise. Outcomes measured at 1 week, 3 week, 3 months, 6 months and 1 year by high frequency component of heart rate variability. Results indicated that exercise peak VO_2, peak cardiac output and parasympathetic nerve activity improved from 3 week itself.

12. **Piarson L et al (2001)**

Studied the effects of training and detraining on combined strength and aerobic exercise program in 14 CABG patients. Selected patients were treated by 2 sessions of aerobic exercise and 2 sessions of strengthening exercise for 8 months. Blood samples and exercise capacity were outcome measures. They concluded that strength and aerobic exercises favors muscular and biochemical adaptation on total cholesterol, triglycerides, HDL, and a significant improvement in exercise capacity.

13. **Craig Cheetam et al (2002)**

Compared Myocardial infarction and CABG patients to find out the effect of aerobic exercise induced changes in peak exercise capacity. Patients were randomized as (Myocardial infarction) Group A and (CABG) Group B. both groups received physical training for 3 months. They concluded that significant increase in PVO_2 in both groups. There was no significant difference seen in between these groups.

14. **Sato S et al (2003**)

Performed a study on 81 CABG patients by comparing effect of aerobic and strength training on exercise capacity . patients were randomized into aerobic exercise group and strength training group. Treadmill outcomes of both groups were measured after 6 months. Results showed that aerobic exercise cuused early and sustained benefit in exercise capacity while the effects of strength exercise training were late onset.

15. **Tokmakidis et at (2005)**

Studied effect of power exercise and aerobic exercise training on haemostatic factors among 55 male CABG patients. Patients randomized into control group, aerobic exercise group and power exercise group for 6 months intervention. Treadmill haemostatic factor is the outcome measure. Results indicated that fibrinogen concentration was significantly lower in the aerobic group and an early favorable change in treadmill performance was seen in aerobic group than in power group.

3.0 DESIGN AND METHODOLOGY

METHODOLOGY

3.1 **Study Design**; Matched Subject Experimental design

3.2 **Study Setting**; The study was conducted at MADHA MEDICAL COLLEGE HOSPITAL KUNDRATHUR and MADRAS MEDICAL MISSION HOSPITAL, MUGAPAER

3.3 **Study Duration**; The study was conducted for a period of 4 months.

3.4 **Study Sampling**; The total number of 20 subject after coronary artery bypass grafting were selected by convenient sampling method after due consideration of inclusion and exclusion criteria and they all were divided into Group 1 and Group 2.
Group 1: Aerobic exercise training
Group 2: Circuit weight training

3.5 **Subjects**;

All subjects with coronary artery disease who were attending the outpatient department of cardiac rehabilitation were selected. A total of 20 subjects were included for the study, using purposive sampling methods. They were divided into two groups, Group 1 and Group 2. Group 1 consists of 10 subjects who were given aerobic exercise after Coronary artery bypass grafting. Group 2 consists of 10 subjects who were given circuit weight training capacity after coronary artery bypass grafting.

Inclusion Criteria

- ⇨ Following uncomplicated Bypass surgery after 3 months
- ⇨ Mild or no left ventricular dysfunction
- ⇨ Ejection fraction > 40%
- ⇨ Sex- Male
- ⇨ Age group 40 - 60 years
- ⇨ Functional capacity greater than 5 Metabolic Equivalents (MET)

Exclusion criteria

- ⇨ Subjects with pulmonary disease
- ⇨ Atrial and ventricular arrhythmias
- ⇨ Exertional hypertension
- ⇨ Exercise induced ischaemia of more than 0.2 mv
- ⇨ Valsalva maneuver
- ⇨ Subjects with renal failure
- ⇨ Orthopedic and neurological disorder

Variable

Independent variable;

- Aerobic exercise training
- Circuit weight training

Dependent variable;

- Treadmill [(Bruce protocol exercise capacity level in metabolic equivalents) (MET)]

MATERIALS

- Treadmill equipments and its accessories
- Circuit training and its accessories
- Stethoscope
- Sphygmomanometer

PROCEDURE

A total of 20 subjects who were undergone Coronary artery bypass grafting 3 months before were selected by convalescent sampling based up on inclusion criteria

Experimental Group (Group 1)

Before giving Aerobic exercise training the pretest score of metabolic equivalents (MET) was taken.

Technique;

Aerobic Exercise Training

Phase 1

- Warm up exercise given for 10 minutes

Phase 2

- Individual walking program for 20 minutes
- MODE: Sub Maximal Aerobics
- INTENSITY: started with 60% heart rate gradually increasing up to 80%.
- DURATION: 30 to 45 minutes.
- FREQUENCY: 3 to 5 days/ week.

Phase 3

The cool down period of exercise for 10 minutes.

The total duration of Aerobic training was 4 months. After completion of aerobic exercise training the post test scores of metabolic equivalents (MET) was taken.

Control Group (Group 2)

Interrupted Circuit Training

Phase 1

- Warm up exercise given for 10 minutes

Phase 2

- Exercise done using weight training unit.
- Exercises included;-
    - Bench Press
    - Leg Press
    - Sit Ups
    - Shoulder Press
    - Squats
    - Curls
- INTENSITY: started with 60% heart rate gradually increasing up to 80%.
- DURATION: A rest period (30 sec – 1 minute) is taken between each bout of exercise 8 – 10 Repetition Maximum.
- FREQUENCY: 3 to 5 days/ week.

Phase 3

- The cool down period of exercise for 10 minutes.
  After completion of aerobic exercise training the post test scores of metabolic equivalents (MET) was taken.

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STATISTICAL METHODS

In the study paired 't' test & Unpaired 't' test was used as a statistical tool to find the significance of improvements in between pre and post test in experimental group.

PAIRED/MATCHED/DEPENDENT 't' test

When we use same group of samples in the pretest and in post test then we can analyse the data using paired 't' test using the following formula;-

- ✓ Find the Mean of the difference $\bar{d}$
- ✓ Find the standard deviation of the differences S.D
- ✓ Calculate the standard error of the mean $S.E\ (\bar{d}) = S.D/\sqrt{n}$

To calculate 't', divide the mean of the difference by the standard error of the mean.

$$t = \frac{\bar{d}}{SE(\bar{d})}$$

Where

$\bar{d}$ .Is the mean of the differences

SE is the standard deviation of the differences

N is the number of pairs

INDEPENDENT T - TEST /UNPAIRED T – TEST

When we compare the means two independent sample groups, we can use the student independent t-test.It is obtained using the formula.

When the difference between the means is divided by this standard errors the result is 't'.

Thus,

$$t = \frac{(\bar{x}_1 - \bar{x}_2)}{\sqrt{\left(\frac{S_P{}^2}{n_1} + \frac{S_P{}^2}{n_2}\right)}}$$

$s_P{}^2$ is the pooled variance

$$s_P{}^2 = \frac{(n_1-1)s_1{}^2 + (n_2-1)s_2{}^2}{n_1+n_2-2}$$

Arithmetic Mean

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$$

Where $\sum_{i=1}^{n} x_i = x_1 + x_2 + x_3 + x_4 + \ldots . x_n$

Standard Deviation: A measure of the dispersion among the elements in a set of data. Standard deviation can be defined as follows:

$$s = \sqrt{\frac{\sum_{i=1}^{n} (X_i - \bar{\mu})^2}{n - 1}}$$

Where:

$\bar{\mu}$	is the mean, i is the index
n	is the total number of data points
X_i	represents a data point

4.0 DATA ANALYSIS AND INTERPRETATION

This chapter deals with the analysis and interpretation of data collected from 20 subjects after coronary artery bypass grafting to compare the exercise capacity between pre and post test values in response to aerobic and circuit weight training exercise for 3 months.

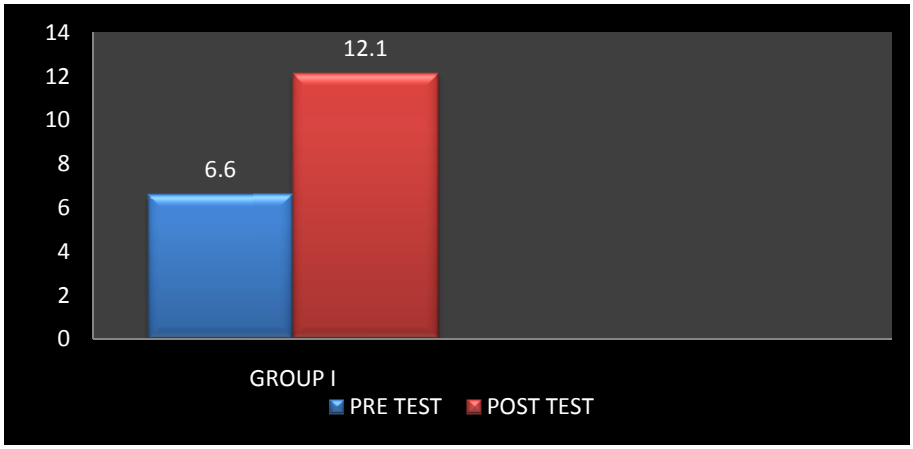
Table 4.1: Group 1

The comparative mean value, mean difference, standard deviation and paired 't' value between pre and post test of exercise capacity in Group 1

Test	Mean	Mean Difference	Standard Deviation	Paired 't' value
Pre Test	6.6	5.8	0.87	19.44
Post Test	12.1			

The paired 't' value 19.44 was greater then the tabulated 't' value 2.26, which showed that there was statistically significant difference at 0.05 level between pre Vs post test results. The pretest mean was 6.6, post test mean was 12.1 and mean difference was 5.6, which showed increased exercise capacity in response to aerobic exercise training for 3 months.

GRAPH 4.1. MEAN VALUE OF EXERCISE CAPACITY IN GROUP I



Graph 4.1

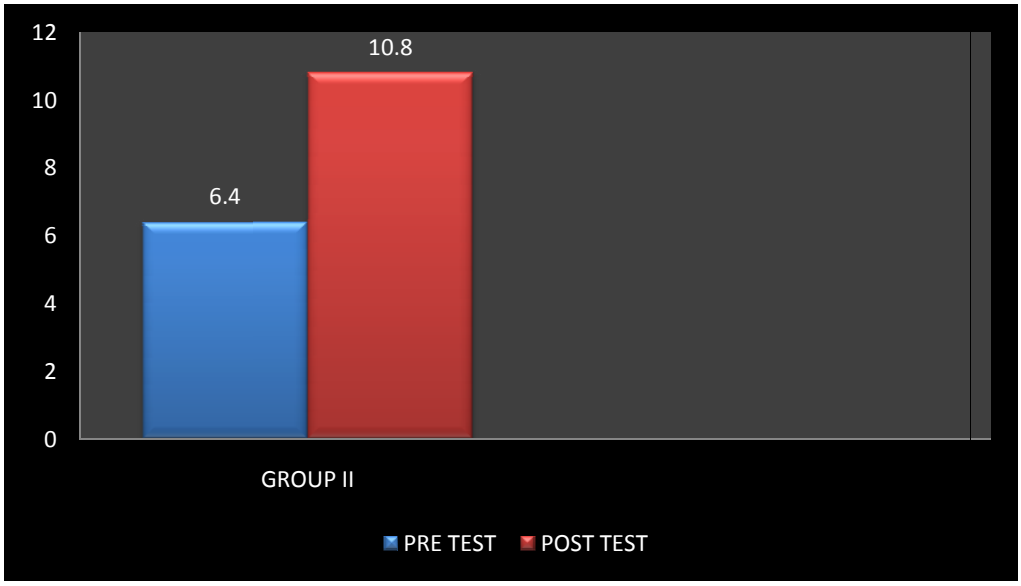
Table 4. 2: Group 2

The comparative mean, mean difference, standard deviation and paired 't' value between pre and post test of exercise capacity in Group 2.

Test	Mean	Mean Difference	Standard Deviation	Paired 't' value
Pre Test	6.4	4.4	1.32	10.53
Post Test	10.8			

The paired 't' value 10.53 was greater than the tabulated 't' value of 2.26, which showed that there was statistically significant difference at 0.05 level between pre Vs post test results. The pre test mean was 6.4, post test mean was 10.8 and mean difference was 4.4, which showed increased exercise capacity in response to circuit weight training for 3 months.

GRAPH 4.2.MEAN VALUE OF EXERCISE CAPACITY IN GROUP II



Graph 4.2

Table 4.3:

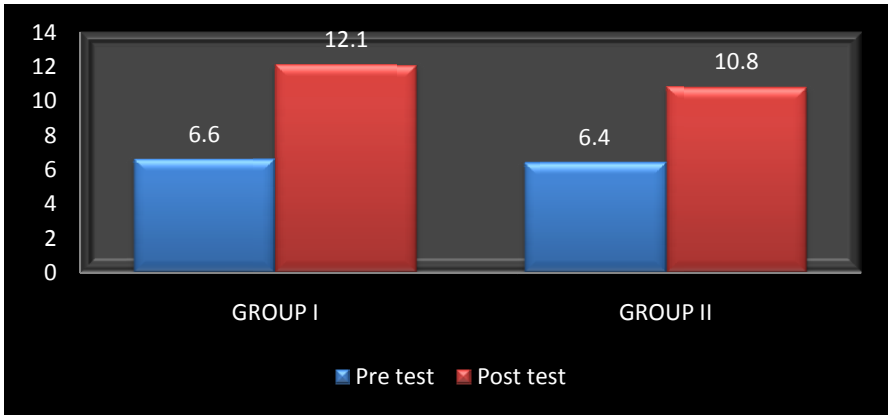
Table 3 shows the comparative mean values, mean difference, standard deviation and unpaired 't' value of exercise capacity between Group 1 and Group 2.

Test	Mean	Mean Difference	Standard Deviation	Paired 't' value
Pre Test	5.8	1.2	1.16	2.3
Post Test	4.4			

The unpaired 't' value of 2.3 was greater than the tabulated 't' value of 2.10, which showed that there was statistically significant difference at 0.05 level between mean difference of Group 1 and Group 2. The pre Vs post test mean of Group 1 was 5.8, the pre Vs post test mean of Group 2 was 4.4 and mean difference of Group 1 and Group 2 was 1.2, which showed that there was more increase in exercise capacity in response to treatment of Group 1 compared to Group 2.

Therefore the study is rejecting the null hypothesis and accepting the alternative hypothesis.

GRAPH 4.3.MEAN DIFFERENCE OF EXERCISE CAPACITY IN GROUP I & GROUP II



Graph 4.3

5.0 RESULTS

The result of this study shows that aerobic exercise training shows significant improvement in exercise capacity than circuit weight training in coronary artery bypass graft patients.

6.0 DISCUSSION

The aims of the study was to compare the effect of aerobic exercise training and circuit weight training on improving exercise capacity in coronary artery bypass grafting patients.

Stahle A et al (1999) conducted an experimental study with 65 elderly patients after an acute coronary event to find out the effect of aerobic training in exercise capacity and heart rate variability. The selected patients were divided into two groups;- one group is control and second group received outpatient group aerobic training program 50 minutes, 3 times a day for 3 months. The treatment outcome was measured by ECG recordings. The results of this study concluded that a regular aerobic exercise improved exercise capacity and modified heart rate variability.

In the analysis and interpretation of exercise capacity in Group 1;

The paired 't' value of 19.44 was greater than the tabulated 't' value of 2.26, which showed that there was statistically significant difference at 0.05 level between pre Vs post test results. The pre test mean was 6.6, post test mean was 12.1 and mean difference was 5.6, which showed increased exercise capacity in response to aerobic exercise training for 3 months.

D. Wosorui, et al (1996) conducted an experimental study on 81 men after CABG to compare the effects of aerobic and strength exercise training.

The selected patients were grouped into two. 1st group received aerobic exercise training and 2nd group received strength exercise training for 6 months. The treatment outcomes of both groups were assessed by treadmill. The result of this study concluded that aerobic exercise training causes early and sustained benefits in exercise capacity while the effects of strength exercise training are later onset.

Based on the above study treadmill was taken as parameter in the present study.

Vanhees L et al (1995) conducted a comparative study between Myocardial Infarction and CABG to find out the prognostic value of aerobic training induced changes in peak exercise capacity. The selected patients were assigned into 2 groups. First group included myocardial infarction patients and second group received physical training for 3 months. The results of this study concluded that there was a significant increases in PVo_2 in both groups. But there was no significant difference seen in between these groups.

The study results of Stahle et al (1999) and Vanhees L et al (1995) supported the results of present study in which aerobic exercise has got improved in exercise capacity in above mentioned parameters in group A CABG patients.

In the analysis and interpretation of exercise capacity in Group 2;

The paired 't' value of 10.53 was greater than the tabulated 't' value of 2.26, which showed that there was statistically significant difference at 0.05 level between pre Vs post test results. The pre mean was 6.4, post mean was 10.8 and mean difference was 4.4, which showed increased exercise capacity in response to circuit weight training for 3 months.

Maiorana et al (1997) conducted an experimental study on 26 post coronary bypass male patients to find out the effect of circuit weight training on muscular strength, peak O2 consumption and myocardial O2 demand. The selected patients were grouped into two. One controlled and another group received circuit weight training for 10 weeks. Both groups were assessed by 1 RM technique for muscular strength and treadmill for VO2. The results showed that moderate intensity circuit weight training was safe and improved strength.

Hannal RG et al (1991) conducted an experimental study on 24 post coronary artery bypass patients to find out the effect of hydraulic circuit training on stroke volume, cardiac output, aerobic power, muscular, strength and endurance. The selected patients were grouped into 3 groups. One group was controlled and another group received hydraulic circuit training for 8 weeks, 3 circuit per day, at work rest ratio 1:1, the 3rd group received cycle training exercises on bicycle ergometer for 8 weeks. The treatment outcomes were measured by Cybex 2 isokinetic dynamometer for muscular strength and endurance and symptoms limited graded exercise test on bicycle ergometer for cardio vascular fitness. The result showed that hydraulic circuit training can elicit significant improvement in both cardiovascular fitness and muscular strength and endurance than cycle training group.

The study results of Maiorana et al (1997) and Hannal RG et al (1991) supported the result of present day in which circuit weight training showed improvement in exercise capacity in above mentioned parameter in group 2 CABG patients.

In comparison of Group 1 and Group 2 in the analysis and interpretation of exercise capacity between group 1 and group 2;

In the analysis and interpretation of exercise capacity the unpaired 't' value of 2.3 was greater than the tabulated 't' value 2.1 at 0.05 level which showed that there was

statistically significant difference between pre Vs post test results of Group 1 and 2. The mean values of Group 1 was 5.6, Group B was 4.4 and the mean difference was 1.2 which showed that there was significant increase of exercise capacity in Group 1 compared to Group 2 in response to treatment.

D. Wosornu et al (1996) conducted a experimental study on 81 men after CABG to compare the effects of aerobic and strength exercise training on exercise capacity. The selected patients were grouped into two. 1st group received aerobic exercise training and 2nd group received strength exercise training for 6 months. The treatment outcomes of both groups were assessed by treadmill. The result of this study concluded that aerobic exercise training caused early and sustained benefits in exercise capacity while the effects of strength exercise training are later onset.

Wosornu D et al (1968) conducted an experimental study on 55 male patients after CABG to find out the effect of power exercise and aerobic exercise training on haemostatic factors. The selected patients were divided into 3 groups. 1st group was controlled, 2nd group received aerobic training and 3rd group received power exercise for 6 months. The results were assessed by treadmill, haemostatic factor. The result of this study concluded that fibrinogen concentration was significantly lower in the aerobic group and an early favorable change in treadmill performance was seen in aerobic group than in power group.

The study results of D. Wosornu et al (1996 and 1968) supported the present study in which exercise capacity has got improved in aerobic exercise than circuit weight training exercise in CAN+BG patients.

Reason for improvement in group 1 who underwent aerobic exercise training Aerobic exercise results in improved cardiac performance due to the following mechanisms;-

- ✓ Aerobic exercise results in improved myocardial O_2 supply by increased utilization of O_2 and increased content of oxidative enzymes in myocardial cells.
- ✓ Improved left ventricular function with decreased end diastolic volumes.
- ✓ Aerobic exercise results in increased HDL - c level; reduced LDL - c level and reduced Triglycerine level.
- ✓ Aerobic exercise results in decreased in both resting and exercise Blood Pressure due to decrease in the sympathetic nervous system activity via decrease in plasma

nor epinephrine level, decreased sodium reabsorption associated with lowered serum insulin level and decreased blood volume.

- ✓ Aerobic exercise improves the exercise capacity by increased extraction of O_2 by the trained skeletal muscles.
- ✓ Greater arterial – venous O_2 difference.
- ✓ Significant increase in maximal cardiac output.
- ✓ Increased extraction and utilization of O_2.
- ✓ Maximal O2 uptake results in reduction of heart rate, blood pressure and plasma Catecholamine concentration.
- ✓ Aerobic exercise training decreases the intrinsic rate of firing of SA node.

Reason for improvement in Group 2 who underwent circuit weight training: Circuit weight training results in improved cardiac performance due to the following mechanisms;-

- ➢ Increased sympathetic nervous system response - generalized peripheral vasoconstriction in non exercising muscles, increased arterial blood pressure, which increase myocardial workload and increased myocardial contractility, increased heart rate and systolic Blood Pressure.
- ➢ Increased myocardial contractility, increased stroke volume, cardiac output, blood flow, O_2 utilization of tissue and thereby increased exercise capacity.

Reason for greater improvement in Group 1 who underwent aerobic exercise training: Aerobic exercise results in greater cardiac performance by increasing the myocardial O_2 supply reducing the Blood Pressure, reducing the myocardial workload, while circuit training is associated with increased in arterial Blood Pressure which increases myocardial workload and also causes reduced ejection fraction, left ventricular motion abnormalities and increased incidence of arrhythmias.

These factors make aerobic exercise more suitable for improving exercise capacitry in post CABG patients than circuit weight training.

7.0 SUMMARY AND CONCLUSION

The objectives of the study was to compare the effect of aerobic exercise training and circuit weight training on exercise capacity after CABG.

To conduct the study, a total number of 20 subjects was selected by convenient sampling method after the consideration of inclusion and exclusion criteria.

Treadmill walking Bruce protocol in MET's was taken as parameter to measure exercise capacity. The pre test data was collected for group 1 and group 2 patients and computed.

Group 1 subjects were given aerobic exercise training for 3 – 5 days per week and group 2 were given circuit weight training for 3 - 5 days per week. The result of the post test of some parameter was recorded for comparison after 3 months of treatment.

The paired 't' test was used to compare the pre Vs post test results of Group 1 and Group 2 seperately. The unpaired 't' test was used to compare the mean difference of Group 1 and Group 2.

In the analysis and interpretation of exercise capacity, the unpaired 't' test value of 2.3 was greater than the tabulated 't' value of 2.1 at 0.05 level, which showed that there was statistically significant difference between pre Vs post test results of Group 1 and Group 2.

The mean values of Group 1 was 5.6,, Group 2 was 4.4 which showed that there was significant increase in exercise capacity to Group 2 in response to treatment.

CONCLUSION

The study concluded that there was a significant increase in exercise capacity after the treatment of aerobic exercise training for 4 months.

Thus the study concluded that the aerobic exercise training was the effective treatment for CABG patie

8.0 RECOMMENDATION

- A similar study can be conducted with heart rate variability as parameter to document exercise capacity in post coronary artery bypass graft patients.
- A similar study can be conducted with ejection fraction of left ventricle on post coronary artery bypass graft patients.
- A similar study can be conducted with exercise capacity to find out the effectiveness of other physical therapy techniques on post coronary artery bypass graft patients.
- A similar study can be conducted with the treatment of aerobic training in other conditions like chronic myocardial infarction, valvular replacement surgeries.

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10.0 APPENDIX

1. Assessment Chart

Name:

Age/Gender:

History: Surgical history of CABG more than 3 months duration.

Vital signs:

- Blood Pressure
- Heart Rate
- Temperature
- Respiratory rate

Investigations:

- ECG at rest:
- ECG during Exercise:
- Echo: >40%
- Functional cardiac grade: 2

Diagnosis: Low risk uncomplicated medically stable CABG patients.

Measurement:

Parameter	Before treatment	After treatment
Treadmill		

Signature of Investigator

2.Bruce Protocol

Stage No-	Speed mph	Grade%	Time	MET
1	1.7	10	3	5
2	2.5	12	3	7
3	3.4	14	3	10
4	4.2	16	3	13
5	5.0	18	3	16
6	5.5	20	3	19
7	6.0	22	3	22

3.Classification of Cardiac disability

Class	Description
1	Ordinary activity does not cause symptoms of undue fatigue, palpitations, dyspnoea, or angina pain.
2	Greater than ordinary physical activity results in symptoms.
3	Ordinary physical activity results in symptoms.
4	Symptoms at rest and worse with any physical activity.

4.Impairment rating scale

VO_2 max	Peak MET	Activity
> 25	>7	None
20 – 25	5 – 7	Mild to moderate
15 – 20	2.5 – 5	Severe
< 15	< 2.5	Total

5.Informed consent

Name:

Age/ Gender:

Occupation:

Address:

DECLARATION

I have fully understood the nature and purpose of the study. I accept to be a subject in this study. I declare that the above information is true to my knowledge.

Date:

Place:

Signature of subject:

6.Master chart

Aerobic Exercise capacity in Metabolic equivalents (MET)

S.No	Group 1 - Aerobic Exercise	
	Pre Test	***Post Test***
1.	6.8	***13.0***
2.	***6.9***	***13.4***
3.	***5.1***	***10.8***
4.	***7.1***	***12.6***
5.	***7.0***	***13.6***
6.	***5.1***	***9.8***
7.	***7.2***	***10.0***
8.	***5.0***	***10.4***
9.	***7.1***	***13.1***
10.	***6.8***	***13.3***

Circuit Weight Training Exercise capacity in Metabolic equivalents (MET)

S.No	Group 2 - Circuit Weight Exercise Training	
	Pre Test	***Post Test***
1.	7.1	***9.8***
2.	***6.9***	***10.3***
3.	***5.2***	***9.9***
4.	***6.8***	***10.0***
5.	***5.0***	***9.8***
6.	***7..3***	***11.2***
7.	***5.1***	***9.8***
8.	***6.8***	***10.5***
9.	***7.2***	***10.4***
10.	***6.8***	***13.3***